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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/691,746	10/22/2003	Dimitry Shur	8640	1979

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EXAMINER	
JOHNSTON, PHILLIP A	

ART UNIT	PAPER NUMBER
2881	

MAIL DATE	DELIVERY MODE
11/09/2009	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/691,746	SHUR ET AL.	
	Examiner	Art Unit	
	PHILLIP A. JOHNSTON	2881	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *19 August 2009*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-18* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-18* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *22 October 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *8-192009*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

Detailed Action

1. This Office Action is submitted in response to Amendment filed 8-19-2009, wherein claims 1, 3, 6, 11, 12, 14-16 and 18 are amended. Claims 1-18 are pending.

Examiners Response to Arguments

2. Applicants arguments are moot in view of new grounds for rejection necessitated by the applicant's amendment.

Claims Rejection – 35 U.S.C. 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which the subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claim 1-18 is rejected under 35 U.S.C. 103(a) as being unpatentable over Essers USPN 6,590,210, in view of Chen, USPN 6,064,486, and further in view of Bowes, USPN 6,778,275.

5. Regarding claim 11, Essers discloses the use of a scanning electron microscope (SEM) in metrology applications that includes;

(a) Lenses, deflectors, electrodes and control devices for directing the primary electron beam along an optical axis and deflecting the beam through an orifice that lies on an axis parallel to the optical axis and is then deflected back to the optical axis (note Figure 9) to irradiate a specimen. Col. 5, line 37-61, and Col. 21, line 43-54,

(b) Use of the SEM for investigating sensitive specimens and imaging a specimen in metrology applications, which is equivalent to inspecting an object. Col. 2, line 3-7; and Col. 2, line 50-55,

(c) Use of first and second in-lens detectors, positioned so that electrons pass through an aperture in the first in-lens detector 18 and are detected by the second in-lens detector 74. Col. 7, line 5-32,

Essers fails to disclose; measuring alignment errors between the overlying layers of a sample, where the sample has a first feature formed on a first layer of the inspected object, a second feature formed on a second layer of the inspected object, and an intermediate layer positioned between the first and second layers, where the second feature is buried under the first layer.

Chen discloses at Col. 1, line 39-44 that, alignment of one patterned layer to underlying layers is attributed to variations in the overlay of the various mask's used in lithography processing of semiconductor devices, where measurement of overlay is performed with the assistance of special alignment marks that are designed into each mask level. When the alignment marks are aligned, it may be assumed that the remainder of the patterned layer is also properly aligned.

Chen also discloses at Col. 5, line 3-10 a primary electron beam directed to an alignment mark having feature 11 below the surface of a sample 12, where the second layer of sample 12 includes a second feature (11 or 11') buried under the first layer 21 or 21', where the second feature effects the shape of an area in the first layer due to asymmetries of

the coating process as shown in Figures 2A and 2B below. See also Col. 5, line 46-64.

FIG. 2A

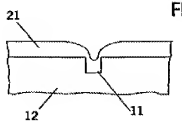
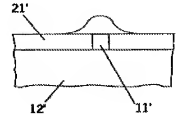


FIG. 2B



Chen modifies Essers to provide an apparatus for aligning a pattern by projecting a beam to underlying patterns and detecting the position of an alignment mark, where the alignment signal is a function of the topography of the alignment mark and all overlying layers, which make up the alignment signal model used to identify the center position of the new alignment mark from which the center position of the beam is determined.

Essers discloses the use of a SEM the semiconductor industry for automated monitoring in production of metrology applications which require accurate centering of the beam along the optical axis by using alignment coils and their control devices. See Col. 2, line 50-57; Col. 5, line 49-61; and Col. 6, line 17-24.

Therefore it would have been obvious to one of ordinary skill in the art that Essers would use the alignment technique of Chen to measure the overlay across a multilayered alignment mark, in order to provide beam position determination with high accuracy thereby improving the registration accuracy of the layers to the substrate during integrated circuit processing. Col. 1, line 23-38.

The combination of Essers and Chen fails to teach the use of an overlay measurement mark having multiple layers containing first and second features and intermediate layers,

where the first feature is located on the first layer and the second feature is located on the second layer such that they are not overlapping.

Bowes discloses at Col. 11, line 62-67; and Col. 12, line 1-13, an overlay measurement mark having a box-in-box structure with a first layer 640 including feature 410 and a second layer 630 with plural features located below the first layer, some of which are not overlapping (430, 450 etc.) as shown in Figure 6 below. Bowes also discloses at Col. 12, line 6-13, that the overlay mark structure includes additional intermediary layers.

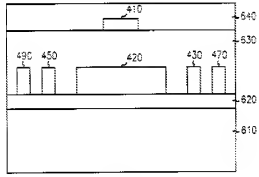


FIG. 6

Bowes modifies the combination of Essers and Chen to provide a layered mark for measuring layer misalignment induced by process fabrication steps and for estimating overlay errors. [0012] and 0053].

Essers discloses the use of a SEM the semiconductor industry for automated monitoring in production of metrology applications and the importance of using an accurately centered beam in a scanning electron microscope by using alignment coils and their control devices. See Col. 2, line 50-57; Col. 5, line 49-61; and Col. 6, line 17-24.

Therefore it would have been obvious to one of ordinary skill in the art that the combination of Essers and Chen would use the multi-layered alignment mark of Bowes to

determine beam misalignment in a scanning electron microscope and adjust the beam along the optical axis to correct for aberrations thereby helping to insure that the semiconductor devices fabricated by the beam perform well.

6. Regarding claim 12, Essers discloses using an applied field between the specimen and the final electrode to deflect scattered electrons toward a collecting orifice, as well as the magnetic field generated by the lens 64. See Col. 7, line 12-24 and Col. 8, line 18-36.

7. Regarding claims 13 and 14, Essers discloses adjusting the parameters of the apparatus such as beam energy to improve detection efficiency of sensitive specimens, from which one of ordinary skill in the art would recognize that adjusting beam energy would include determining the depth required for the beam to interact with a second feature while detecting the electrons scattered from both using in-lens detectors. See Col. 2, line 3-7 and Col. 18, line 34-46.

8. Regarding claims 15-18, the combination of Essers, Chen and Bowes discloses all the claimed limitations as described above regarding claim 11, and Essers also discloses directing the beam to interact with both first and second features while detecting the scattered electrons with the in-lens detectors, as described above regarding claim 13.

9. Regarding claims 1 and 6, the combination of Essers, Chen and Bowes discloses the apparatus used to perform all the steps of this method claim, as described above regarding claim 11, wherein Essers discloses directing the beam of an SEM to an inspected object and deflecting the beam through an orifice that lies on an axis parallel to the optical axis, which is then deflected back to the optical axis to irradiate a specimen. Essers also teaches use of

first and second in-lens detectors, positioned so that electrons pass through an aperture in the first in-lens detector and are detected by a second in-lens detector,

Chen discloses an alignment mark for measuring overlay having a first feature formed on a first layer of the inspected object, a second feature formed on a second layer of the inspected object, and an intermediate layer positioned between the first and second layers, wherein the second feature is buried under the first layer.

Bowes discloses an overlay alignment mark having a first feature located on a first layer and a second feature located on the second layer such that they are not overlapping.

Essers would be motivated to modify the SEM apparatus with the alignment mark configurations of Chen and Bowes because Essers describes the use of a SEM the semiconductor industry for automated monitoring in production of metrology applications and notes the importance of accurately centering the beam along the optical axis by using alignment coils and their control devices.

10. Regarding claims 2-4, and 7-9, the combination of Essers and Chen discloses the apparatus used to perform each step of these method claims, as described above regarding claims 1, 6, and 11-18.

11. Regarding claims 5 and 10, the combination of Essers and Chen discloses the apparatus used to perform all the steps of these method claims, as described above regarding claims 11-18. Essers fails to disclose a preliminary step of charging the second feature; however, Essers discloses at Col. 3, line 38-50 that charge buildup occurs during irradiation with a scanning electron microscope, where the effect of charge buildup is reduced in operation using a low primary energy and a good detection efficiency.

Essers allows the initial beam exposure to charge up the sample since the imaging signal to noise ratio is good using a low primary beam energy and high detector efficiency.

Therefore one of ordinary skill in the art would recognize that Essers uses no charge build up neutralization technique such that the first or initial exposure of the sample to the beam is equivalent to a preliminary step of charging, which would include charging the second feature when irradiation begins.

Conclusion

12. The Amendment filed on 8-19-2009 has been considered but the arguments are moot in view of new grounds for rejection.

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

13. Any inquiry concerning this communication or earlier communications should be directed to Phillip Johnston whose telephone number is (571) 272-2475. The examiner

can normally be reached on Monday-Friday from 7:00 am to 4:00 pm. If attempts to reach the examiner by telephone are unsuccessful, the examiners supervisor Robert Kim can be reached at (571) 272-2293. The fax phone number for the organization where the application or proceeding is assigned is 571 273 8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

PJ

October 19, 2009

/ROBERT KIM/
Supervisory Patent Examiner, Art Unit 2881